

What is claimed is:

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1. Apparatus for supporting a substrate in a chamber having at least one substrate support member coupled to the chamber, comprising:
 - a body having a first portion and a second portion, the first portion adapted to interface with the support member;
 - a socket disposed in the second portion and having a ball support surface; and
 - a ball rotatably disposed on the ball support surface in the socket, the ball adapted to contact and support a substrate thereon.
 2. The apparatus of claim 1, wherein the ball is coated, plated or electropolished.
 3. The apparatus of claim 1, wherein the ball is coated or plated with chromium, an aluminum alloy, silicon nitride, or tungsten nitride.
 4. The apparatus of claim 1, wherein the ball support surface has a radius greater than a radius of the ball.
 5. The apparatus of claim 1, wherein the ball support surface is conical.
 6. The apparatus of claim 1, wherein the ball support surface further comprises:
 - at least one depression or groove; and
 - a plurality of ball support balls disposed in the depression or groove that support the ball.
 7. The apparatus of claim 1 further comprising:
 - a plurality of ball support balls disposed between the ball support surface and the ball.

8. Apparatus for supporting a glass substrate, comprising:
a chamber body;
at least one support member coupled to the chamber body; and
one or more balls disposed on the support member, the balls rotatably adapted to support the glass substrate in a spaced-apart relation to the support member.
9. The apparatus of claim 8 further comprising:
a spacer having a first portion and a second portion, the first portion disposed on the support member and the second portion having a socket that rotatably retains the ball therein.
10. The apparatus of claim 9, wherein the socket further comprises:
a ball support disposed inside a cylindrical sidewall.
11. The apparatus of claim 10, wherein the ball support further comprises:
a curved surface having a single contact point with the ball.
12. The apparatus of claim 10, wherein the ball support further comprises:
a conical surface contacting the ball.
13. The apparatus of claim 10, wherein the ball support centers the ball within the socket.
14. The apparatus of claim 8, wherein the ball has a surface roughness of 4 micro-inches or smoother.
15. The apparatus of claim 9 further comprising:
a plurality of mounting pins coupled to the support member, each pin coupled to a respective spacer.
16. The apparatus of claim 15, wherein the first portion is hollow and receives at least a portion of the mounting pin.

17. The apparatus of claim 8, wherein at least one of the balls is positioned to support a center portion of the substrate.

18. The apparatus of claim 8, wherein some of the balls support a perimeter portion of the substrate and at least one of the balls is positioned to support a center portion of the substrate.

19. The apparatus of claim 8, wherein a plurality of spacers having fixed top surfaces support a perimeter portion of the substrate and at least one of the balls is positioned to support a center portion of the substrate.

20. The apparatus of claim 8, wherein the balls are coated, plated or electropolished.

21. The apparatus of claim 8, wherein the balls are coated or plated chromium, an aluminum alloy, silicon nitride, or tungsten nitride.

22. The apparatus of claim 8, wherein each support member further comprises:

a plurality of ball support balls disposed between the support member and the ball.

23. Apparatus for supporting a glass substrate comprising:

a chamber body;

at least one support member coupled to the chamber body;

one or more balls disposed on the support member, the balls rotatably adapted to support the glass substrate in a spaced-apart relation to the support member; and

a spacer having a first portion and a second portion, the first portion disposed on the support member and the second portion having a socket that rotatably retains the ball therein.

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24. The apparatus of claim 23, wherein the socket further comprises:
a ball support surface disposed inside a cylindrical sidewall.
25. The apparatus of claim 24, wherein the ball support surface further comprises:
a curved surface having a single contact point with the ball.
26. The apparatus of claim 24, wherein the ball support surface further comprises:
a conical surface contacting the ball.
27. The apparatus of claim 24, wherein the ball support surface centers the ball within the socket.
28. The apparatus of claim 23, wherein the ball has a surface roughness of 4 micro-inches or smoother.
29. The apparatus of claim 23 further comprising:
a plurality of mounting pins coupled to the support member, each pin coupled to a respective spacer.
30. The apparatus of claim 29, wherein the first portion is hollow and receives at least a portion of the mounting pin.
31. The apparatus of claim 23, wherein at least one of the balls is positioned to support a center portion of the substrate.
32. The apparatus of claim 23, wherein the plurality of spacers include a first group having a non-rotating surface supporting a perimeter portion of the substrate and a second group having balls supporting a center portion of the substrate.

33. The apparatus of claim 23, wherein the balls are coated, plated or electropolished.

34. The apparatus of claim 23, wherein the balls are coated or plated chromium, an aluminum alloy, silicon nitride, or tungsten nitride.

35. The apparatus of claim 23, wherein the chamber body is a thermal treatment chamber.

36. The apparatus of claim 23, wherein the chamber body further comprises:
a first substrate transfer port disposed on a first sidewall; and
a second substrate transfer port disposed on a second sidewall.

37. The apparatus of claim 23, wherein the chamber body further comprises:
a first substrate transfer port disposed on a first sidewall; and
a second substrate transfer port disposed on a second sidewall.

38. The apparatus of claim 23 further comprising:
a plurality of ball support balls disposed between a ball support surface of the support member and the ball.

39. The apparatus of claim 23, wherein the ball moves laterally relative to the support member.

40. Apparatus for supporting a glass substrate, comprising:
a substrate heating chamber having at least one sidewall;
a plurality of support members coupled to the sidewall;
at least one spacer disposed on each support member, the spacer having a first portion and a second portion, the first portion disposed on the support member and the second portion having a socket; and
a ball rotatably disposed in the socket and adapted to support the glass substrate in a spaced-apart relation to the support member.

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41. The apparatus of claim 40, wherein the substrate heating chamber is an annealing chamber.
42. The apparatus of claim 40 further comprising:
a plurality of ball support balls disposed between a ball support surface of the socket and the ball.
43. The apparatus of claim 40, wherein the ball moves laterally and/or rotates relative to the socket.
44. Apparatus for supporting a glass substrate, comprising:
a load lock chamber having a first substrate transfer port disposed in a first sidewall and second substrate transfer port disposed in a second sidewall;
at least one support member disposed in the chamber;
at least one spacer disposed on the support member, the spacer having a first portion and a second portion, the first portion disposed on the support member and the second portion having a socket; and
a ball rotatably disposed in the socket and adapted to support the glass substrate in a spaced-apart relation to the support member.
45. The apparatus of claim 44 further comprising:
a plurality of ball support balls disposed between a ball support surface of the socket and the ball.
46. The apparatus of claim 44, wherein the ball moves laterally and/or rotates relative to the socket.

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